San Francisco Bay Area Regional Priority Projects and Programs Attachment 7 – Economic Analysis: Water Supply Costs and Benefits

Project 1. Regional Recycled Water Program

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1 Summary

The Bay Area Regional Recycled Water Program includes the implementation of 10 recycled water supply projects within the Bay Area Water region. Together, the projects will enable the use 3,210 acre-feet per year (AFY) of recycled water for landscape and agricultural irrigation, and commercial and industrial purposes. In each case, the use of recycled water made available through the proposed projects will offset the use of potable water supplies, including water imported from the San Francisco Bay and Sacramento-San Joaquin Deltas, local surface water, and a limited amount of groundwater supplies.
The San Francisco Bay Area region has a long history of regional recycled water planning. In the early 1990s, Bay Area water and wastewater agencies formed a partnership with the US Bureau of Reclamation (USBR) and DWR to study the feasibility of a regional approach to water recycling in the Bay Area region. This partnership resulted in the formation of the Bay Area Regional Water Recycling Program (BARWRP), which produced the BARWRP Master Plan in 1999. BARWRP), demonstrated that large-scale implementation of recycled water would improve water supply reliability and water quality in the San Francisco Bay and Delta, and contribute to long-term restoration of the Bay-Delta environment. BARWRP continues to serve as the foundation of regional recycled water planning throughout the Bay Area today.

In addition, the South Bay Water Recycling Program (SBWR) was initiated in 1991 to provide a reliable, sustainable and drought-proof supply of recycled water to the South Bay area. The SBWR provide a case study of a complex partnership between local, state and federal agencies including entities such as San Jose, Santa Clara and Milpitas, five sanitation districts, the U.S. Bureau of Reclamation, Environmental Protection Agency, California Department of Water Resources, Department of Health Services, Regional Water Quality Control Board and Santa Clara Valley Water District.

In 2003, water supply and clean water agencies throughout the North Bay counties of Marin, Sonoma and Napa began meeting to investigate opportunities to expand the use of recycled water for agricultural and other purposes. Co-sponsored by USBR, the North Bay Water Reuse Authority Program (NBWRA Program) was initiated to identify a regional recycled water program to increase water supply, reduce discharges to the North Bay and provide ecosystem enhancements. Finally, smaller scale collaboration efforts between water purveyors and sanitation districts have also multiplied in the recent years, as illustrated by some of the recycled water projects presented in this grant application. Generally, the recycled water projects included in this grant application are a direct product of BARWRP, SBWR, and NBWRP planning efforts.

Table 1 provides a summary of the Bay Area Regional Recycled Water Program projects included in this grant application. A summary of the project costs and water supply benefits of the Bay Area Regional Recycled Water Program are provided in Table 2. Total project costs and water supply benefits are discussed in the remainder of this attachment.

Table 1. Bay Area Regional Recycled Water Program Projects Summary

Project Proponent	Project Name	Project Description	AFY
A.Central Contra Costa Sanitary District	Concord Recycled Water Project, Phase I	Construction of 2.5 miles of underground pipeline to provide recycled water to 34 sites in the City of Concord for landscape irrigation.	190
B. Dublin San Ramon Services District	Central Dublin Recycled Water Distribution and Retrofit Project	Construction of 14,000 linear feet of distribution pipeline to provide recycled water to 11 sites in Dublin for landscape irrigation.	240
C. East Bay Municipal Utilities District	East Bayshore Project, Phase IA (I-80 Pipeline)	Construction of a transmission pipeline from Emeryville to Albany, distribution pipelines in Emeryville, Berkeley, Albany, and customer retrofits to provide recycled water for irrigation purposes.	210
D. Marin Municipal Water District	Peacock Gap Recycled Water Extension	Construction of 8.5 miles of pipeline to existing MMWD recycled water distribution line, conversion of a 500,000-gallon potable water storage tank into recycled water storage, and installation of recycled water meters.	320
E. North Bay Water Reuse Authority (includes 4 sub-projects)			1,490
i. North Marin Water District/Novato Sanitary District	Novato North Service Area Project	Treatment capacity expansion at the Novato Sanitary District's Davidson WWTP to 1.7 MGD (peak day capacity), construction of distribution pump station, retrofit of the 0.5 MG Plum St. Tank for recycled water storage, and installation of 4.6 mi of pipeline.	*186*
ii. Las Gallinas Valley Sanitation District/North Marin Water District	Novato South Service Area Project	Implementation of 0.7 mgd treatment upgrade at the LGVSD WWTP or expansion of an existing tertiary treatment facility, construction of a booster pump station and 5.8 mile pipeline distribution system, and retrofit of the 0.5 MG Reservoir Hill Tank for recycled water storage.	*204*
iii. Napa Sanitation District	Napa State Hospital Pipeline Construction, Stage 1	Construct 24" recycled water pipeline along Napa College and through the Napa State Hospital (NSH) property.	*1,000*
iv. Sonoma Valley County Sanitation District	Sonoma Valley Recycled Water, Stage 1	Construction of distribution pipeline, improvements at SVCSD's treatment plant, and design and construction of a recycled water reservoir with capacity of between 60 – 100 AF.	*100*
F. San Francisco Public Utilities Commission	Harding Park Recycled Water Project	Construction of a pipeline along Lake Merced Boulevard to Harding Park, a 700,000 gal underground storage tank, and a pump station. Project will tie into existing recycled water system.	260
G. South Bay Water Recycling	Industrial Expansion and Reliability	Construction of 6,000 feet of pipeline to distribute recycled water to data centers in City of Santa Clara; construction of a potable backup system to ensure continuous supply of over 10,000 AFY of recycled water to SBWR customers in the event that water produced by the Advanced Water Treatment Facility becomes unavailable; construction of potable backup system to ensure the continuous supply of 100 AFY of recycled water for Mineta-San Jose International Airport; development of a regional message to promote the use of recycled water in the San Francisco Bay Area.	500
		Total Regional Bay Area Recycled Water Project	3,210

Table 2. Water Supply Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	$53,089,000
Monetizable Benefits	
Avoided Alternative Water Supply Projects Costs	$46,175,000
Avoided Potable Water Supply Costs	$34,764,000
Total water supply benefits	$80,939,000
Qualitative Benefits or Costs	**Qualitative indicator***
Increased Water Supply Reliability	++
Improved Operational Flexibility for Delta Water Providers	+
Delayed Regional Desalination Facility	

O&M = Operations and Maintenance
* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

2 Costs

Capital costs for the project amount to $54,219,000 (2009 USD)[1]. Individual project capital costs range from $1,639,000 for the East Bay Municipal Utility District (EBMUD) East Bayshore I-80 Pipeline Project to $10,425,000 for the Novato Sanitary District/ North Marin Water District Novato North Service Area Project.

With the exception of the Novato North Service Area Project and Novato South Service Area Project (NBWRA Program components E.i and E.ii), all projects are assumed to have a useful project life of 50-years. The majority of these projects will be fully online by 2013 (with most beginning to provide benefits in the last half of 2012). Thus, costs are calculated through 2062 for these projects (50 years after the projects come online).

Both Projects E.i and E.ii include treatment facility components, which typically have a shorter lifetime than pipeline/distribution projects. The useful life of these two projects is assumed to be 25 years. Construction of these projects will be completed in 2012 and 2013, respectively. Costs are therefore calculated through 2037 and 2038 for these projects (25 years after they become fully online 2013 and 2014). NBWRA Program components (Projects E.i through E.iv) are the only proposed projects that have

[1] This reflects capital costs that will be incurred in 2011 through 2013. Capital costs that were expended in 2009 and 2010 are considered sunk costs and are not reflected in this analysis.

incremental costs associated with project administration, operation, maintenance, and periodic replacement. These costs amount to $17,163,000 (non-discounted 2009 USD) over the useful life of the respective projects.

Together, the present value capital and O&M costs for the Bay Area Regional Recycled Water Program amount to about $53,089,000 through 2062. Table 3 provides a summary of the present value costs of the Regional Recycled Water Program. Present value costs of individual components of the Regional Recycled Water Program are provided in Appendix A.

3 The "Without Project" Baseline

The San Francisco Bay Area Region encompasses nine California counties, including Napa, Marin, Sonoma, Solano, Contra Costa, San Francisco, Alameda, San Mateo, and Santa Clara. The number of people living and working within the region is projected to increase significantly over the next 25 years. Even after accounting for savings associated with the existing and planned water conservation activities, water demands are projected to exceed available supplies in some areas as soon as 2018 (BAWSCA 2010). Within the Bay Area Water Supply and Conservation Agency (BAWSCA) service areas alone[2], up to 25 million gallons per day (mgd) of additional water supply may be needed by 2035 to meet the needs of the current and future residents, businesses, and organizations in normal (i.e., non-drought) years (BAWSCA 2010).

About 70% of the water supply in the Bay Area region is imported from the San Francisco Bay Delta or the Sacramento-San Joaquin Delta, via the CalFed Bay-Delta Project, State Water Project (SWP) or the Central Valley Project (CVP). Excluding recycled water use, the remainder of the region's supply is made up of groundwater and local surface water sources (such as the Russian River and the Mokelumne River). The availability of water imported from the Delta is subject to a number of natural and human forces, ranging from increased population growth (and accompanying increased demands), to drought and earthquakes, environmental regulations and water rights determinations. The availability of drinking water from the Delta is further threatened by the potential for levee failure that could lead to flooding and seawater intrusion, which would result in non-drinkable water. Global climate change and rising sea levels may also create greater stress on the levee system.

In addition, many of the aquifers in the San Francisco Bay region are currently being pumped at or near practical sustainable yield. Local surface water supplies are also limited due to existing water rights and diversions by multiple users, low flows during summer (which coincides with the irrigation season) and dry years, and in-stream flow requirements for riparian habitat and aquatic species.

Water suppliers in the Bay Area Region recognize that the use of recycled water is key to meeting future demands within the region. Without the Bay Area Recycled Water Program, municipal, industrial, and agricultural users will continue to use potable water for irrigation and other non-potable uses. This will increase reliance on imported supplies within the region. Thus, without the recycled water projects, water supply reliability within the Bay Area will decrease. In addition, without the project, some entities (i.e., those benefitting from the NBWRA Program) will not be able to meet potable demands. These entities

[2] BAWCSA includes 24 cities and water districts, and two private utilities that purchase water wholesale from the San Francisco regional water system. These entities provide water to 1.7 million people, businesses and community organizations in Alameda, Santa Clara and San Mateo counties.

will need to implement alternative water supply projects if the NBWRA Program is not implemented. The avoided costs associated with these alternative water supply projects are discussed in subsequent sections.

4 Water Supply Benefits

This section describes the water supply benefits generated by the Bay Area Regional Recycled Water Program Projects, including: (1) Avoided water supply projects costs; (2) Avoided potable water supply costs; (3) Improved water supply reliability; and, (4) Improved operational flexibility for Delta Water providers.

Avoided Water Supply Project Costs

As shown in Table 1, the NBWRA Program will offset the use of 1,490 AFY of potable water with recycled water within the NBWRA service areas. Without this project, water suppliers within Napa, Marin, and Sonoma counties would need to rely on the construction of the Russian River Water Supply Project in order to meet potable water demands in future years.

The Russian River Project would increase potable water supplies to the NBWRA service area by releasing and using additional water currently stored in Lake Sonoma, and diverting water from the Russian River. Construction of the Russian River Project would begin in 2012 and would be completed in 2018. This "avoided project" consists of approximately 74,000 feet of 18 to 36-inch diameter pipelines, a storage tank with a capacity of approximately 4 MG and modification to an existing booster pump station, and other appurtenances. Capital costs for this project would amount to $174,479,000 (2009 USD), and average annual O&M costs would be about $1,841,000 (2009 USD). Over the life of the project, total present value capital and O&M costs for this project would amount to $139,925,000 (2009 USD), as shown in Table 4.

The proposed phase of the NBWRA Program would only supply 1,490 AFY of the total 4,654 AFY (approximately 33 percent) that would be available upon completion of the entire program. Therefore, it is assumed that the avoided Russian River Water Project would still be built if the proposed project is not implemented, but at a smaller scale. To offset the amount of recycled water that would otherwise be used if the NBWRA Program were not implemented, NBWRA would use about 33% of the water generated by the Russian River Project. Thus, 33% of the Russian River project costs are assumed to be avoided by the NBWRA Program. The total present value avoided costs therefore amount to $46,175,000.

Present value avoided costs for the avoided project are calculated through 2037 to match the useful life of the two NBWRA Program components that have a 25-year project life. In practice, the avoided costs would be greater because the Russian River Project would be expected to last at least 50-years (thus, O&M costs would continue to accrue). However, after 2037, both the Novato SD/NMWD Novato North Service Area Project and the LGVSD/NMWD Novato South Service Area Project would likely need major repairs or replacements. These costs are not known, thus, it would be unfair to count benefits after 2037 without knowing the comparative costs.

Table 3- Annual Cost of Project
(All costs in 2009 Dollars)
Project: REGIONAL RECYCLED WATER PROGRAM

	Initial Costs	Operations and Maintenance Costs [1]						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs	Discount Factor	Discounted Costs(g) x (h)
2009								1.00	$0
2010								0.943	$0
2011	$30,268,198	$5,000	$0	$0	$0	$0	$30,273,198	0.890	$26,943,146
2012	$18,755,234	$14,750	$129,300	$112,000	$0	$0	$19,011,284	0.840	$15,969,479
2013	$5,195,076	$21,550	$179,600	$218,000	$59,136	$0	$5,673,362	0.792	$4,493,303
2014	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.747	$358,400
2015	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.705	$338,249
2016	$0	$21,550	$181,100	$233,000	$59,136	$0	$494,786	0.665	$329,033
2017	$0	$25,150	$181,100	$218,000	$179,136	$0	$603,386	0.627	$378,323
2018	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.592	$284,033
2019	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.558	$267,721
2020	$0	$21,550	$181,100	$233,000	$116,736	$0	$552,386	0.527	$291,107
2021	$0	$21,550	$181,100	$218,000	$116,736	$0	$537,386	0.497	$267,081
2022	$0	$25,150	$181,100	$218,000	$236,736	$0	$660,986	0.469	$310,002
2023	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.442	$212,065
2024	$0	$21,550	$181,100	$233,000	$59,136	$0	$494,786	0.417	$206,326
2025	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.394	$189,036
2026	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.371	$178,001
2027	$0	$25,150	$181,100	$218,000	$269,136	$0	$693,386	0.350	$242,685
2028	$0	$21,550	$181,100	$233,000	$59,136	$0	$494,786	0.331	$163,774
2029	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.312	$149,693
2030	$0	$21,550	$181,100	$218,000	$116,736	$0	$537,386	0.294	$157,991
2031	$0	$21,550	$181,100	$218,000	$116,736	$0	$537,386	0.278	$149,393
2032	$0	$41,950	$181,100	$233,000	$796,736	$0	$1,252,786	0.262	$328,230
2033	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.247	$118,507
2034	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.233	$111,790
2035	$0	$21,550	$181,100	$218,000	$59,136	$0	$479,786	0.220	$105,553
2036	$0	$21,550	$181,100	$233,000	$59,136	$0	$494,786	0.207	$102,421
2037	$0	$25,150	$181,100	$218,000	$179,136	$0	$603,386	0.196	$118,264
2038	$0	$11,800	$104,000	$96,000	$59,136	$0	$270,936	0.185	$50,123
2039	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.174	$12,734
2040	$0	$300	$8,750	$20,000	$59,136	$0	$88,186	0.164	$14,463
2041	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.155	$11,344
2042	$0	$3,900	$8,750	$5,000	$179,136	$0	$196,786	0.146	$28,731
2043	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.138	$10,100
2044	$0	$300	$8,750	$20,000	$59,136	$0	$88,186	0.130	$11,464
2045	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.123	$9,002
2046	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.116	$8,490
2047	$0	$3,900	$8,750	$5,000	$179,136	$0	$196,786	0.109	$21,450
2048	$0	$300	$8,750	$20,000	$59,136	$0	$88,186	0.103	$9,083
2049	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.097	$7,099
2050	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.092	$6,733
2051	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.087	$6,367
2052	$0	$20,700	$8,750	$20,000	$739,136	$0	$788,586	0.082	$64,664
2053	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.077	$5,635
2054	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.073	$5,343
2055	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.069	$5,050
2056	$0	$300	$8,750	$20,000	$59,136	$0	$88,186	0.065	$5,732
2057	$0	$3,900	$8,750	$5,000	$179,136	$0	$196,786	0.061	$12,004
2058	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.058	$4,245
2059	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.054	$3,952
2060	$0	$300	$8,750	$20,000	$59,136	$0	$88,186	0.051	$4,497
2061	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.048	$3,513
2062	$0	$300	$8,750	$5,000	$59,136	$0	$73,186	0.046	$3,367
Project Life	$54,219,000	$644,000	$4,969,000	$5,958,000	$5,592,000	$0	$71,382,000		
							Total Present Value of Discounted Costs (Sum of Column (i))		$53,089,000
							Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries		
Comments: Note that total Project Cost have been rounded to the nearest $1,000.									

(1) The incremental change in O&M costs attributable to the project.

In addition to avoiding the NBWRA Program described above, implementation of the other proposed Bay Area Regional Recycled Water Program Projects may help delay implementation of a regional desalination facility that is currently being explored by the Bay Area's four largest water agencies: East Bay Municipal Utility District, San Francisco Public Utilities Commission, Contra Costa Water District, and Santa Clara Valley Water District. The planned facility would provide up to 65 million gallons per day. SFPUC estimates that the cost of producing desalinated water would amount to about $2,550 per AF ($1,050 more than the current cost of potable supplies). Delaying this project would result in savings for water providers and their customer. The timing or magnitude of delay is not known, therefore, this benefit is not included in the economic analysis tables.

Avoided Potable Water Supply Costs

Excluding the NBWRA Program (Projects E.i through E.iv), at full implementation, the Bay Area Regional Recycled Water Program will provide 1,720 AFY of recycled water for non-potable uses within the Bay Area Water Region. This will result in the reduced reliance on water imported from the Delta via SWP and CVP and local surface water supplies.

To calculate the avoided costs of imported water over time, the amount of avoided imported water (488 AF in 2012, 1,720 AFY beginning in 2013 after all projects are brought online) is multiplied by the estimated average cost to retail suppliers in the Bay Area (currently $1,500 per AF of treated water). As a result of the project, Bay Area water providers (excluding water providers within the NBWRA service area) will avoid the use of 86,488 AF of potable water through 2062. Assuming no real increases in the cost of potable supplies, the total present value benefits associated with the avoided cost of potable supplies amounts to about $34,764,000 as shown in Table 5.

Improved Water Supply Reliability

The reliability of a water supply refers to the ability to meet water demands on a consistent basis, even in times of drought or other constraints on source water availability. By avoiding the use of potable water for non-potable uses, the Bay Area Regional Recycled Water Program will improve water supply reliability throughout the Bay Area. As noted above, the availability of imported water is subject to climatic changes (i.e., drought) and other unforeseen events such as earthquakes and floods. Further, there are few opportunities for further development of groundwater or local surface water supplies within the region.

Although interest in water supply reliability is increasing (e.g., due to increasing water demands and concerns over climate-related events), only a few studies have directly attempted to quantify its value (i.e., through non-market valuation studies). The results from these studies indicate that residential and industrial (i.e., urban) customers seem to value supply reliability quite highly. Stated preference studies find that water customers are willing to pay $95 to $500 per household per year (in 2009 USD) for total reliability (i.e., a 0% probability of their water supply being interrupted in times of drought).

Table 4: Annual Costs of Avoided Projects
(All avoided costs in 2009 dollars)
Project: REGIONAL RECYCLED WATER PROGRAM

	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): NBWRA Russian River Water Project Avoided Project Description: Increase potable water supplies to the water districts in the study area by releasing and using additional water currently stored in Lake Sonoma, and divert and redivert the water from the Russian River (comparable in size and scope to proposed NBWRA Project).				Discount Factor	Discounted Costs
	Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives		
2009					1	$0
2010					0.943	$0
2011	$ 21,809,936			$ 21,809,936	0.89	$19,410,843
2012	$ 21,809,936			$ 21,809,936	0.84	$18,320,346
2013	$ 21,809,936			$ 21,809,936	0.792	$17,273,469
2014	$ 21,809,936			$ 21,809,936	0.747	$16,292,022
2015	$ 21,809,936			$ 21,809,936	0.705	$15,376,005
2016	$ 21,809,936			$ 21,809,936	0.665	$14,503,607
2017	$ 21,809,936			$ 21,809,936	0.627	$13,674,830
2018	$ 21,809,936			$ 21,809,936	0.592	$12,911,482
2019			$ 1,841,400	$ 1,841,400	0.558	$1,027,501
2020			$ 1,841,400	$ 1,841,400	0.527	$970,418
2021			$ 1,841,400	$ 1,841,400	0.497	$915,176
2022			$ 1,841,400	$ 1,841,400	0.469	$863,617
2023			$ 1,841,400	$ 1,841,400	0.442	$813,899
2024			$ 1,841,400	$ 1,841,400	0.417	$767,864
2025			$ 1,841,400	$ 1,841,400	0.394	$725,512
2026			$ 1,841,400	$ 1,841,400	0.371	$683,159
2027			$ 1,841,400	$ 1,841,400	0.35	$644,490
2028			$ 1,841,400	$ 1,841,400	0.331	$609,503
2029			$ 1,841,400	$ 1,841,400	0.312	$574,517
2030			$ 1,841,400	$ 1,841,400	0.294	$541,372
2031			$ 1,841,400	$ 1,841,400	0.278	$511,909
2032			$ 1,841,400	$ 1,841,400	0.262	$482,447
2033			$ 1,841,400	$ 1,841,400	0.247	$454,826
2034			$ 1,841,400	$ 1,841,400	0.233	$429,046
2035			$ 1,841,400	$ 1,841,400	0.22	$405,108
2036			$ 1,841,400	$ 1,841,400	0.207	$381,170
2037			$ 1,841,400	$ 1,841,400	0.196	$360,914
2038				$ -	0.185	$0
2039				$ -	0.174	$0
Project Life	$ 174,479,000	$ -	$ 34,987,000	$ 209,466,000		
					Total Present Value of Discounted Costs (Sum of Column (g))	$139,925,000
					(%) Avoided Cost Claimed by Project	33%
					Total Present Value of Discounted Avoided Project Costs Claimed by alternative Project (Total Present Value of Discounted Costs x % Avoided Cost Claimed by Project)	$46,175,000

Draft Phase 3 Engineering and Economic/Financial Analysis Report, CDM, Revised August 26, 2010 (Chapter 9); Sonoma County Water Agency Annual Audit for period ending June 30, 2009.

Table 5 - Annual Water Supply Benefits
(All benefits in 2009 dollars)
Project: REGIONAL RECYCLED WATER PROGRAM

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project	(g) Unit $ Value (1)	(h) Annual $ Value (1)	(i) Discount Factor (1)	(j) Discounted Benefits (1)
2009								1.00	$0
2010								0.943	$0
2011								0.890	$0
2012	Avoided potable water use	AF	0	488	488	$1,500	$732,500	0.840	$615,300
2013	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.792	$2,043,360
2014	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.747	$1,927,260
2015	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.705	$1,818,900
2016	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.665	$1,715,700
2017	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.627	$1,617,660
2018	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.592	$1,527,360
2019	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.558	$1,439,640
2020	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.527	$1,359,660
2021	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.497	$1,282,260
2022	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.469	$1,210,020
2023	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.442	$1,140,360
2024	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.417	$1,075,860
2025	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.394	$1,016,520
2026	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.371	$957,180
2027	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.350	$903,000
2028	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.331	$853,980
2029	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.312	$804,960
2030	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.294	$758,520
2031	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.278	$717,240
2032	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.262	$675,960
2033	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.247	$637,260
2034	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.233	$601,140
2035	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.220	$567,600
2036	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.207	$534,060
2037	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.196	$505,680
2038	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.185	$477,300
2039	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.174	$448,920
2040	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.164	$423,120
2041	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.155	$399,900
2042	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.146	$376,680
2043	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.138	$356,040
2044	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.130	$335,400
2045	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.123	$317,340
2046	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.116	$299,280
2047	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.109	$281,220
2048	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.103	$265,740
2049	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.097	$250,260
2050	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.092	$237,360
2051	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.087	$224,460
2052	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.082	$211,560
2053	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.077	$198,660
2054	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.073	$188,340
2055	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.069	$178,020
2056	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.065	$167,700
2057	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.061	$157,380
2058	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.058	$149,640
2059	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.054	$139,320
2060	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.051	$131,580
2061	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.048	$123,840
2062	Avoided potable water use	AF	0	1,720	1,720	$1,500	$2,580,000	0.046	$118,680
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$34,764,000

Comments: Column G represents the average weighted avoided costs of potable supplies across all projects. This reflects the avoided costs for the various water suppliers in the Bay Area that are a part of the project. These benefits do not include the potable water that will be offset by the NBRWA Program (1,490 AFY). The benefits asscoiated with these projects are reflected in the avoided water supply projects detailed in Table 13 and 13A.

(1) *Complete these columns if dollar value is being claimed for the benefit.*

For most studies, this is what households would be willing to pay in addition to their current water bill. The challenge in using these values to determine a value of increased reliability as a result of the proposed project is recognizing how reasonably interpret these survey-based household monetary values. The values noted above reflect a willingness to pay per household to ensure complete reliability (zero drought-related use restrictions in the future), whereas the Regional Recycled Water Projects enhance overall reliability, but do not guarantee 100% reliability. Thus, if applied directly to the number of households within the Bay Area region, the dollar values from the studies would overstate the reliability value provided by the proposed project. Due to the uncertainty involved in applying these numbers to this situation, this benefit estimate is not included in the economic analysis tables. However, given the magnitude of the proposed projects, and the number of households within the Bay Area, if monetized, this benefit would be significant.

Improved Operational Flexibility for Delta Water Providers

By avoiding the use of imported water, the project will marginally help SWP and CVP in their supply operations, allowing for longer shutdown, deferring capital improvements, and improving reliability in a vulnerable part of the system. The value of this increased operational flexibility is not monetized in the benefit tables.

5 Distribution of Project Water Supply Benefits, and Identification of Beneficiaries

In terms of water supply benefits, the Regional Recycled Water Program will benefit stakeholders at the local, regional, and state level, as is summarized in Table 6. At the local level, Bay Area water providers and residents will benefit due to avoided imported water supply costs and increased reliability of supply. Regionally, Delta water providers will benefit from improved operational flexibility. Statewide water supply benefits include reduced demand on the San Francisco Bay Delta and Sacramento-San Joaquin Delta (ecological benefits for the CALFED Bay Delta are discussed in more detail in Attachment 8). The project also helps meet statewide goals to increase use of recycled wastewater by at least one million AFY by 2020 and by at least two million AFY by 2030 (State Water Resources Control Board, 2009).

Table 6. Project Beneficiaries Summary

Local	Regional	Statewide
Bay Area water providers and residents	Delta water providers	San Francisco Bay and Sacramento-San Joaquin Deltas California reclaimed water use goals

6 Project Benefits Timeline

With the exception of the Novato North Service Area Project (Project E.i) and Novato South Service Area Project (Project E.ii) (NBWRA Program), all projects are assumed to have a useful project life of 50-years. The majority of these projects will be fully online by 2013 (with most beginning to provide benefits at some point in 2012). Thus, for each project, benefits are calculated from the time the project comes online (for most projects, this occurs at some point during 2012) through 2062 (50 years after the projects come online).

Both projects E.i and E.ii include treatment facility components, which typically have a shorter lifetime than pipeline/distribution projects. The useful life of these two projects is assumed to be 25 years. Benefits for these projects are therefore calculated through 2037 and 2038 (25 years after they are fully online in 2013 and 2014, respectively).

7 Potential Adverse Effects from the Project

Adverse impacts resulting from the implementation of the Regional Recycled Water Program consist of potential growth-inducing impacts due to improved water supply reliability. There are no other anticipated adverse potential water supply impacts with the exception of temporary construction-related impacts and water quality and other impacts. Such impacts can include potential water quality impacts from nutrient and salinity loading and emerging contaminants, and potentially increased energy usage and costs (compared to potable supplies) from the treatment process (while overall energy usage and costs are anticipated to be lower as discussed in the *Lower CO_2 Emissions* section of Attachment 8).

8 Summary of Findings

Monetized water supply benefits from the proposed project include an avoided water supply project in the NBWRA service area, and the avoided costs of potable water supplies for all the other Bay Area Recycled Water Program components. Non-monetized benefits of the project include increased water supply reliability in the Bay Area, delayed implementation of a regional desalination facility, and improved operational flexibility for Delta water providers.

The present value costs of the avoided Russian River water supply project in the North Bay amount to $46,175,000. In addition, excluding the NBWRA Program, the Bay Area recycled Water Program will avoid the use of 86,488 AF of potable water through 2062. Total present value avoided costs associated with this water amount to about $34,764,000. To calculate the value of avoided potable water use for non-NBWRA Program, it was assumed that the average weighted cost of treating and delivering surface water (both imported water and local surface water) within the Bay Area is about $1,500 per AF. Overall, the avoided cost of implementing the Bay Area Recycled Water Project is estimated at $80,939,000.

As mentioned earlier, there are additional, qualitative benefits associated with the Bay Area Recycled Water Project. These benefits are described in Table 7. Because this analysis of costs and benefits is based on available data and some assumptions, there may be some omissions, uncertainties, and possible biases. In most cases, omissions lead to a downward bias in benefits: the project is expected to be much more beneficial than the subset of benefits that can be monetized would indicate.

Table 7. Omissions, Biases, and Uncertainties, and Their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided Water Supply Project Costs	U	The calculation of the present value of costs is a function of the timing of capital outlays and a number of other factors and conditions. Changes in these variables will change the estimate of costs.
Delayed Regional Desalination Facility	+	By avoiding potable uses, this project may help to delay implementation of a regional desalination facility in the Bay Area. The timing and costs of the facility are uncertain but if the desalination were delayed as a result of the recycled water projects, this would result in relatively significant savings.
Increased Water Supply Reliability	+	The monetized estimate of the potential benefit of increased water supply reliability as a result of the project has not been included due to uncertainties to applying values from the literature to a partial improvement in water supply reliability.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

San Francisco Bay Area Regional Priority Projects and Programs Attachment 7 – Economic Analysis: Water Supply Costs and Benefits

Project 2. Regional Water Conservation Program

Contents **Page**

1 Summary

This program offers drought relief and long-term water savings in the form of a package of water conservation programs to improve water use efficiency throughout the San Francisco Bay Region. This project was developed in response to recent dry years and other strains on Bay Area water supplies and the Delta.

The participating water agencies developed the following three specific programs that were determined to provide the most quantifiable and sustainable water savings:

(1) *Landscape Water Conservation Programs:* This project is a three part program:

a. The *Water-Efficient Landscape Education Program* will provide outreach, education and trainings to convert traditional urban landscaping to water-efficient and sustainable landscaping and support the water-efficient landscape and weather-based irrigation controller rebates. This program will save 47 acre-feet per year (AFY).

b. The *Water Efficient Landscape Rebate Program* will focus on replacing existing water intensive lawns with water efficient landscapes. Region wide, the program will replace more than 3 million square feet of lawn with water efficient landscaping and efficient irrigation, saving 282 AFY

c. The *Weather-Based Irrigation Controllers (WBICs) Rebate Program* will replace standard automatic landscape timers with self-adjusting irrigation controllers that schedule irrigation events based on actual site conditions and weather data. The program will install 2,000 WBICs controlling more than 33,000 residential, commercial, and institutional sprinkler sites stations, saving 266 AFY.

(2) *High-Efficiency Toilet (HET)/High-Efficiency Urinal (HEU) Rebates and Direct Install Program:* This program will enable water agencies to implement a combination of rebates and direct installation programs. The program would include residential, commercial, industrial and institutional (CII) customer classes. Rebates for HETs and HEUs will offer incentives for the replacement of existing high-volume toilets and urinals with high efficiency models, saving 697 AFY

(3) *Regional High-Efficiency Washer Program:* This program will extend the current Bay Area Regional Rebate Program. Installation of a high efficiency washer will save households more than 8,000 gallons of water per year. Savings from this program will be 1,254 AFY This program offers a dual benefit by reducing energy consumption and therefore carbon emissions.

The Regional Water Conservation Program will reduce water demand, preserving current potable supplies and reducing stress on the San Francisco Bay and Sacramento-San Joaquin Delta. **Table 1** provides an overview of the costs and benefits presented in Attachment 7 and 8. The remainder of this attachment discusses Water Quality and Other Benefits, as directed for Attachment 8.

Table 1. Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	$12,721,554
Monetized Benefits	
Water Supply Benefits	
Avoided Purchased Water Costs	$24,670,740
Total Monetized Benefits	$24,670,740
Quantified Benefits	
Other Benefits	
Reduced CO_2 Emissions	7,816 Metric Tons
Qualitative Benefit or Cost	Qualitative indicator*
Water Supply Benefits	
Improved Water Supply Reliability	+
Improved Operational Flexibility	+
Water Quality Benefits and Other Benefits	
Reduced Pollution from Dry Weather Runoff	++
Reduced Stress on the Bay Delta	+
Reduced Street Maintenance Costs	+
Avoided Wastewater Treatment Costs	+

O&M = Operations and Maintenance
* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

2 Costs

The Program budget funds the various elements of the conservation programs. All costs are considered implementation costs, with no post implementation administration, operations or maintenance costs. The program costs will be spread over an implementation period from October 1, 2011 through September 30, 2013; 12.5% of the costs will be incurred in 2011, 50% will be incurred in 2012, and the remaining 37.5% will be incurred in 2013. This corresponds with a 24-month implementation period with 3 months in 2011, 12 months in 2012 and 9 months in 2013. The present value of costs over the project implementation period is $12,721,554. The calculation of present value costs is shown in Table 2.

Table 2- Annual Cost of Project
(All costs should be in 2009 Dollars)
Project: Regional Water Conservation Program

	Initial Costs	Operations and Maintenance Costs [1]						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (f)	Discount Factor	Discounted Costs(g) x (h)
2009	$0						$0	1.000	$0
2010	$0						$0	0.943	$0
2011	$1,919,945						$1,919,945	0.890	$1,708,751
2012	$7,679,779						$7,679,779	0.840	$6,451,014
2013	$5,759,834						$5,759,834	0.792	$4,561,789
2014	$0						$0		
2015	$0						$0		
2016	$0						$0		
2017	$0						$0		
2018	$0						$0		
2019	$0						$0		
2020	$0						$0		
2021	$0						$0		
2022	$0						$0		
2023	$0						$0		
Project Life	10-Years							…	
								Total Present Value of Discounted Costs (Sum of Column (i))	$12,721,554
								Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries	

3 The "Without Project Baseline"

The San Francisco Bay Area Region encompasses nine counties, including Napa, Marin, Sonoma, Solano, Contra Costa, San Francisco, Alameda, San Mateo, and Santa Clara. Based on the Association of Bay Area Governments' (ABAG) projections, population in the Bay Area is expected to increase by nearly 25% to 9 million in 2035. Even after accounting for savings associated with the existing and planned water conservation activities, water demands are projected to exceed available supplies in some areas as soon as 2018 (BAWSCA 2010). Within the Bay Area Water Supply and Conservation Agency (BAWSCA) service areas alone[1], up to 25 million gallons per day (mgd) of additional water supply may be needed by 2035 to meet the needs of the current and future residents, businesses, and organizations in normal (i.e., non-drought) years (BAWSCA 2010).

[1] BAWCSA includes 24 cities and water districts, and two private utilities that purchase water wholesale from the San Francisco regional water system. These entities provide water to 1.7 million people, businesses and community organizations in Alameda, Santa Clara and San Mateo counties.

About 70% of the water supply in the Bay Area Water region is imported from the Sacramento-San Joaquin Delta, via the State Water Project (SWP), Federal Central Valley Project (CVP), and other USBR federal facilities. Excluding recycled water use, the remainder of the region's supply is made up of groundwater and local surface water sources (e.g., the Russian River, Mokelumne River).

The availability of water imported from the Delta is subject to a number of natural and human forces, ranging from increased population growth (and accompanying increased demands), to drought and earthquakes, and environmental regulations and water rights determinations. The availability of drinking water from the Delta is further threatened by the potential for levee failure that could lead to flooding and seawater intrusion, which would result in non-drinkable water. Global climate change and rising sea levels may also create greater stress on the levee system.

In addition, many of the aquifers in the San Francisco Bay region are currently being pumped at or near practical sustainable yield. Local surface water supplies are also limited due to existing water rights and diversions by multiple users, low flows during summer (which coincides with the irrigation season) and dry years, and in-stream flow requirements for riparian habitat and aquatic species.

Water suppliers in the Bay Area Region recognize that conserving current water supplies is key to meeting future demands within the region. Without the Regional Water Conservation Program, municipal, industrial users will continue to use potable water for landscape irrigation and other non-potable uses. This will increase reliance on imported supplies within the region. Thus without the conservation projects, water supply reliability will decrease.

4 Water Supply Benefits

This section describes the water supply benefits generated by the Regional Water Conservation Program throughout the project life, which is assumed to be 10 years, including avoided water supply costs, increased water supply reliability, and improved operational flexibility for wholesale suppliers.

Total Savings

Implementation of the Regional Water Conservation Program will result in maximum annual savings of 2,546AF. The program will be implemented from October 2011 to September 2013. This results in a ramp-up period where approximately 12.5% of project benefits are realized in 2011, 62.5% of project benefits are realized in 2012, and all the benefits are realized in 2013. This corresponds with a 24-month implementation period with 3 months in 2011, 12 months in 2012 and 9 months in 2013. Benefits are phased out accordingly. Over the 10-year life of the project, total savings will be 25,456 AF.

Program Element	Projected Water Savings
HET/HEU Direct Install/Rebate Program	Replacement of up to 35,000 high-water use toilets and urinals with HETs and HEUs for an estimated savings of 697 AFY.
Regional High-Efficiency Washer Program	Installation of 51,000 HEWs, with an estimated savings of 1,254AFY.
Water-Efficient Landscape Education Program	Water conservation savings of 47 AFY.
Water-Efficient Landscape Rebate Program	Replacement 3.8 million square feet of irrigated lawn with water efficient landscaping with an estimated savings of 282 AFY.
Weather-based Irrigation Controllers (WBIC) Program	Installation of approximately 2,660 WBICs controlling approximately 33,000 sprinkler locations with an estimate savings of 266 AFY.

Total Avoided Cost

To calculate the avoided costs of water over time, the amount of avoided water is multiplied by the estimated marginal cost to retail suppliers in the Bay Area of developing their next best supply option (currently $1,500 per AF of treated water). This avoided cost represents the average avoided marginal cost to a Bay Area water agency to obtain the next supply source from a societal perspective.[2] Over the 10-year life of the proposed project, use of 25,456 AF of potable water will be avoided. Implementation of all the Regional Water Conservation Program will result in an avoided cost of $24,670,740 in present value 2009 dollars. The present value benefits (water supply cost savings) are shown in Table 3. Note that present value benefits would still outweigh present value costs if each AF saved were valued at only about $750 per AF.

Table 3 - Annual Water Supply Benefits
(All benefits should be in 2009 dollars)
Project: Regional Water Conservation Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2009	Avoided Potable Water	acre-feet	0	0	0		$0	1.000	$0
2010	Avoided Potable Water	acre-feet	0	0	0		$0	0.943	$0
2011	Avoided Potable Water	acre-feet	0	318.3	318.3	$1,500	$477,375	0.890	$424,864
2012	Avoided Potable Water	acre-feet	0	1591.3	1591.3	$1,500	$2,386,875	0.840	$2,004,975
2013	Avoided Potable Water	acre-feet	0	2546	2546	$1,500	$3,819,000	0.792	$3,024,648
2014	Avoided Potable Water	acre-feet	0	2546	2546	$1,500	$3,819,000	0.747	$2,852,793
2015	Avoided Potable Water	acre-feet	0	2546	2546	$1,500	$3,819,000	0.705	$2,692,395
2016	Avoided Potable Water	acre-feet	0	2546	2546	$1,500	$3,819,000	0.665	$2,539,635
2017	Avoided Potable Water	acre-feet	0	2546	2546	$1,500	$3,819,000	0.627	$2,394,513
2018	Avoided Potable Water	acre-feet	0	2546	2546	$1,500	$3,819,000	0.592	$2,260,848
2019	Avoided Potable Water	acre-feet	0	2546	2546	$1,500	$3,819,000	0.558	$2,131,002
2020	Avoided Potable Water	acre-feet	0	2546	2546	$1,500	$3,819,000	0.527	$2,012,613
2021	Avoided Potable Water	acre-feet	0	2227.8	2227.8	$1,500	$3,341,625	0.497	$1,660,788
2022	Avoided Potable Water	acre-feet	0	954.8	954.8	$1,500	$1,432,125	0.469	$671,667
2023	Avoided Potable Water	acre-feet	0	0	0	$1,500	$0	0.442	$0
Project Life	10-Years				25,460			…	
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$24,670,740

Improved Water Supply Reliability

The reliability of a water supply refers to the ability to meet water demands on a consistent basis, even in times of drought or other constraints on source water availability. By reducing potable water demand through water use efficiency, the Regional Water Conservation Program will improve water supply reliability within the service areas of the various agencies and also increase the Bay Area region's capacity to manage long-term drought scenarios and other strains on the Bay Area water supplies and the Delta.

[2] Compiled through a survey of the water supply agencies involved in the Regional Water Conservation Program.

Although interest in water supply reliability is increasing (e.g. due to increasing water demands and concerns over climate-related events), only a few studies have directly attempted to quantify its value (i.e., through non-market valuation studies). The results from these studies indicate that residential and industrial (i.e., urban) customers seem to value supply reliability quite highly. Stated preference studies (e.g. Raucher et al., 2006) find that water customers are willing to pay $95 to $500 per household per year (in 2009 USD) for total reliability (i.e., a 0% probability of their water supply being interrupted in times of drought).

Due to the uncertainty involved in applying these numbers to this situation, this benefit estimate is not included in the tables. However, it is provided here to give an idea of the potential magnitude of this benefit.

Improve Operational Flexibility for Wholesale Supplies

By reducing the demand for imported water, the program will help to reduce the pressure on imported supplies from the SWP and CVP during emergencies, and allow for longer shutdowns. Additionally the reduced water demand could lead to the deferring of capital improvements, and improve reliability in a vulnerable part of the system. The value of this increased operational flexibility is not monetized in the benefit tables.

5 Distribution of Project Water Supply Benefits, and Identification of Beneficiaries

In terms of water supply benefits, the Regional Water Conservation Program will benefit stakeholders at the local, regional, and state level, as summarized in Table 3. At the local level, Bay Area water providers and residents will benefit due to avoided imported water supply costs and increased reliability of supply. Regionally, Delta water providers will benefit from improved operational flexibility. Statewide water supply benefits include reduced demand on the San Francisco Bay and Sacramento – San Joaquin Delta. (ecological benefits are discussed in more detail in Attachment 8). The project also helps meet statewide goals to reduce per capita urban water use by 20 percent by year 2020.

Table 3. Project Beneficiaries Summary

Local	Regional	Statewide
Bay Area water suppliers and residents	Delta water providers	San Francisco Bay and Sacramento – San Joaquin Delta, California – water use efficiency goals

6 Project Benefits Timeline

This program will be implemented over a two-year period, beginning on October 1, 2011 and ending on September 30, 2013. A water savings lifespan of ten-years has been identified for all water savings equipment and education in this program. Project benefits are expected to extend over 12 –years, which allows for phase-in implementation over the first two years and a phase-out of benefits at the end of the project.

To calculate water savings by year, it was assumed that the program will be implemented across the timeframe from October 2011 to September 2013. This results in a ramp-up period where approximately 12.5% of project benefits are realized in 2011, 62.5% of project benefits are realized in 2012, and all the benefits are realized in 2013. Full benefits are sustained through 2020. Due to the 10-year lifetime assumed for the project, benefits phase out between 2021 and 2022.

7 Potential Adverse Effects from the Project

There are no adverse effects anticipated from the implementation of this program.

8 Summary of Findings

The monetized water supply benefit from the proposed project is the avoided cost of potable water supplies. Non-monetized benefits of the project include increased water supply reliability in the Bay Area, and improved operational flexibility for Delta water providers.

The Regional Water Conservation Program will cost roughly $12.7 million in present value terms, and it will avoid the use of 25,456 AF of potable water over a phased-in 10-year lifetime period, through 2023. The present value of avoided costs associated with this water amount is over $24.6 million. The average cost of treating and delivering surface water (both imported water and local surface water) was assumed to be $1,500 per AF, based on input from a survey of the water supply agencies involved in the Regional Water Conservation Program.

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In this analysis, the main uncertainties are associated with the assumptions of a ten-year lifetime for certain conservation equipment. This assumption is likely to result in more conservative savings estimates. These issues are listed in Table 4.

Table 4. Omissions, Biases, and Uncertainties, and Their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Project lifetime for Conservation Equipment	++	Lifetime of conservation equipment is assumed to be 10 years. A review of the marketplace showed that high efficiency toilet and urinals have 25 years and 33 years respectively (Haasz, 2010).
Increased water supply reliability	+	The monetized estimate of the potential benefit of increased water supply reliability as a result of the project has not been included due to uncertainties to applying values from the literature to a partial improvement in water supply reliability.
Value of saved water	U	The water savings realized by the project are valued at $1500 per AF. This is a region-wide average estimated by the Bay Area water providers, to reflect the full cost of developing their best suite of new supplies, given that the saved water would otherwise be provided from these new sources. This cost may overstate the value of savings in some instances in the near term, but may also understate the full cost of water supply in other instances, especially in future years where supply costs are likely to increase in real terms.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
- = Likely to decrease benefits.
-- = Likely to decrease net benefits significantly.
U = Uncertain, could be + or -.

References

Haasz, Dana. 2010. Personal communication. November 22, 2010.

Raucher, R.S., J. Henderson, and J. Rice. 2006. An Economic Framework for Evaluating the Benefits and Costs of Water Reuse. WateReuse Foundation. Arlington, VA.

San Francisco Bay Area Regional Priority Projects and Programs Attachment 7 – Economic Analysis: Water Supply Costs and Benefits

Project 4. Regional Green Infrastructure Capacity Building Program

Contents **Page**

1 Summary

The Regional Green Infrastructure Capacity Building Program includes the implementation of three green infrastructure (GI) demonstration projects in the northern, southern and eastern sub-regions of the San Francisco Bay Area. The goal of implementing these projects is to develop and improve techniques for better stormwater management in the Bay Area by: 1) analyzing each project to determine water conservation and/or stormwater quality benefits, and 2) disseminating information on lessons learned from the projects to other cities, counties and water management entities region.

The three demonstration projects that will be implemented as part of the Regional Green Infrastructure Capacity Building Program include:

- San Pablo Spine and Regional Promotion of Green Infrastructure
- Hacienda Avenue Green Street Improvement Project
- Napa Valley Rainwater Harvesting Project

The San Pablo Avenue Stormwater Spine project develops stormwater treatment demonstration projects along San Pablo Avenue from Oakland to San Pablo (7 cities in Alameda and Contra Costa Counties will treat up to 14 acres of impervious surface). Projects will build upon the successful El Cerrito San Pablo Avenue stormwater planters implemented in spring 2010 with federal stimulus funding.

The Hacienda Avenue "Green Street" Improvement project will convert a portion of Hacienda Avenue to a "green street." Project elements include: reducing the roadway width by reclaiming and transforming approximately 25% of the existing roadway surface into a public green space running the length of Hacienda Avenue; implementing linear parkway options to increase the amount of open space in the area; and promoting groundwater replenishment by replacing non-pervious asphalt concrete surfaces with pervious material. Additional proposed improvements include installing bike lanes, planting street trees, installing bioswales and other stormwater treatment facilities, narrowing the existing pavement from 70 to 50 feet, and using open space or alternative permeable paving surfaces to allow stormwater infiltration.

The Napa Valley Rainwater Harvesting project will develop and implement a program that converts wine and other barrels to home rainwater harvesting barrels. The project will also provide funding for rain gardens in Napa Valley. The goals of this project is to coordinate, provide support funding, and conduct performance assessments of rain barrel and rain gardens in Napa Valley to determine what type of rainwater harvesting works best for various purposes in the different environments within the valley.

The San Francisco Estuary Partnership (SFEP) will serve as the lead coordinating agency for this project. Project partners include San Francisco Estuary Institute (SFEI), Stopwaste.org, Caltrans, Napa County, and the cities of American Canyon, Napa, St. Helena, Calistoga, Campbell, San Pablo, Richmond, El Cerrito, Albany, Berkeley, Emeryville, Oakland and the town of Yountville.

A summary of all benefits and costs of the project are provided in Table 1. Project costs and water supply benefits are discussed in the remainder of this attachment.

Table 1. Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	$8,277,336
Monetizable Benefits	
Water Supply Benefits	
Avoided imported water supply costs	$30,359
Total Monetized Benefits	$30,359
Qualitative Benefit or Cost	**Qualitative indicator***
Water Supply Benefits	
Improved water supply reliability	+
Additional future water supply benefits	++
Water Quality Benefits	
Improved surface water quality	+
Improved air quality	+
Increased aesthetics, recreational and educational opportunities	+

O&M = Operations and Maintenance
* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

2 Costs

Present value costs for this project are developed in Table 2. Capital costs for the three projects amount to $9,181,774 (2009 USD). The San Pablo Spine and Regional Green Infrastructure Project and the Hacienda Avenue Green Street Improvement Project account for $4,220,882 and $4,632,557 (2009 USD) of the capital budget, respectively. Capital costs for the Napa Valley Rainwater Harvesting Project are $328,335.

The San Pablo Stormwater Spine Project is scheduled for completion in 2013. For this analysis, it is assumed that the project will come online in 2014 and will have a 20-year useful life. Operations and maintenance (O&M) costs will average about $28,000 per year. Total present value costs over the life of the project will amount to $3,724,914.

The Hacienda Green Street Improvement Project will be completed in 2012. O&M costs for the project (including costs associated with operation, maintenance, project administration, and periodic replacement) will be incurred starting in 2013 and will amount to an average of about $36,000 per year. Over the 25-year project life, total present value capital and O&M costs for the project will amount to $4,277,735.

Project administration costs for the Napa Valley Rainwater Harvesting Project will amount to about $2,000 per year through 2015. Although the project will continue to provide benefits for an estimated 50-years following implementation, the County does not expect to incur any costs after 2015. Total present value capital and O&M costs will amount to $274,686.

Through 2037 (the last year costs are incurred for the pilot projects), total present value capital and O&M costs across all projects amount to $8,277,336.

Table 2- Annual Cost of Project
(All costs should be in 2009 Dollars)
Project: Regional Green Infrastructure Capacity Building Program

	Initial Costs	Operations and Maintenance Costs [1]						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (f)	Discount Factor	Discounted Costs(g) x (h)
2009							$0	1.00	$0
2010							$0	0.943	$0
2011	$781,452	$2,000	$0	$0	$0	$0	$783,452	0.890	$697,272
2012	$6,032,851	$2,000	$0	$0	$0	$0	$6,034,851	0.840	$5,069,274
2013	$2,355,471	$7,000	$1,000	$25,000	$5,000	$0	$2,393,471	0.792	$1,895,629
2014		$9,800	$1,000	$50,200	$5,000	$0	$66,000	0.747	$49,302
2015		$9,800	$1,000	$50,200	$5,000	$0	$66,000	0.705	$46,530
2016		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.665	$42,560
2017		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.627	$40,128
2018		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.592	$37,888
2019		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.558	$35,712
2020		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.527	$33,728
2021		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.497	$31,808
2022		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.469	$30,016
2023		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.442	$28,288
2024		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.417	$26,688
2025		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.394	$25,216
2026		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.371	$23,744
2027		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.350	$22,400
2028		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.331	$21,184
2029		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.312	$19,968
2030		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.294	$18,816
2031		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.278	$17,792
2032		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.262	$16,768
2033		$7,800	$1,000	$50,200	$5,000	$0	$64,000	0.247	$15,808
2034		$5,000	$1,000	$25,000	$5,000	$0	$36,000	0.233	$8,388
2035		$5,000	$1,000	$25,000	$5,000	$0	$36,000	0.220	$7,920
2036		$5,000	$1,000	$25,000	$5,000	$0	$36,000	0.207	$7,452
2037		$5,000	$1,000	$25,000	$5,000	$0	$36,000	0.196	$7,056
Project Life	$9,169,774	$191,000	$25,000	$1,129,000	$125,000	$0			
							Total Present Value of Discounted Costs (Sum of Column (i))		$8,277,336
							Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries		

3 The "Without Project Baseline"

The San Francisco Bay Area encompasses nine counties, including Napa, Marin, Sonoma, Solano, Contra Costa, San Francisco, Alameda, San Mateo, and Santa Clara. In this region, managing stormwater runoff through traditional "grey" infrastructure systems (e.g., storage tunnels and transmission pipelines) results in a variety of challenges, including reduced groundwater recharge, high construction, maintenance, and repair costs; introduction of pollutants into source water, and the inefficient use of water resources. These problems are exacerbated as population and development continue to increase and new challenges arise, such as climate change, increasing energy costs, environmental concerns, and aging water infrastructure.

In light of these challenges, water managers in the Bay Area region recognize that a new, integrated approach to stormwater management will be needed to help ensure that cities, water utilities, and water districts can provide the quality and quantity of water that will be demanded in the future by Bay Area residents. Through the Bay Area IRWMP process, water managers in this region have therefore identified the use of GI and other low impact development (LID) techniques as a critical component of overall water resources management.

The use of GI and LID can result in a number of environmental, economic, and social benefits (i.e., the "triple bottom line," or TBL). In terms of water supply, these benefits include significant water conservation (e.g., through the use of cisterns and rainbarrels).

Although many GI and LID projects have been implemented by local governments, water/wastewater agencies, private developers, and homeowners within the nine county region, there is no database of success stories, cost information, maintenance requirements, and, in the case of rainwater harvesting, the amount of water conserved (or potentially conserved) by various projects. Bay Area water managers have yet to conduct the robust analysis and make a case to policy makers as to the amount of funds needed to implement GI, and what the long term benefits of a regional GI program would be.

Without this project, three important regional test case projects will not be built and analyzed for performance. The result is that there will continue to be only limited, scattered and uncoordinated GI efforts conducted sporadically by individual entities. Lessons learned from those few projects will have much less impact on decision-making throughout the region and opportunities will be lost for further water conservation and groundwater recharge.

4 Water Supply Benefits

This section describes the water supply benefits generated by the proposed project, including avoided imported water supply costs, improved water supply reliability, and future water supply benefits.

Avoided Imported Water Supply Costs

As part of the Napa Rainwater Harvesting Project, a total of 750 rainbarrels will be distributed for use throughout Napa County. A rain barrel is a system that collects and stores rainwater from roofs that would otherwise run off to storm drains and streams. Water stored in rainbarrels can be used for landscape irrigation, washing cars, and other non-potable uses. This will reduce reliance on imported water from the Delta, resulting in cost savings for Napa County water suppliers.

To calculate the value of this benefit, the amount of imported water avoided each year is multiplied by the cost of supplying this water to Napa County residents. It currently costs $1,500 to import, treat, and deliver water to Napa County residents. For the pilot project, about 150 rainbarrels will be installed each year from 2011 through 2015. Each rain barrel will result in a savings of about 667 gallons per year, and benefits will continue to accrue each year over the project's assumed 50-year life.

Through 2060, the Napa County Rainwater Harvesting Project will result in a savings of about 74 AF of rainwater. The value of this water (in terms of avoided imported water supply costs) amounts to $30,359 in present value. This result is shown in Table 3 on the following page.

Table 3 - Annual Water Supply Benefits
(All benefits should be in 2009 dollars)
Project: Regional Green Infrastructure Capacity Building Program

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2009								1.00	$0
2010								0.943	$0
2011	Avoided imported water use	AF	0	0.31	0.31	$1,500	$460	0.890	$410
2012	Avoided imported water use	AF	0	0.61	0.61	$1,500	$921	0.840	$773
2013	Avoided imported water use	AF	0	0.92	0.92	$1,500	$1,381	0.792	$1,094
2014	Avoided imported water use	AF	0	1.23	1.23	$1,500	$1,841	0.747	$1,375
2015	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.705	$1,623
2016	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.665	$1,531
2017	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.627	$1,443
2018	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.592	$1,363
2019	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.558	$1,284
2020	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.527	$1,213
2021	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.497	$1,144
2022	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.469	$1,079
2023	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.442	$1,017
2024	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.417	$960
2025	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.394	$907
2026	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.371	$854
2027	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.350	$806
2028	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.331	$762
2029	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.312	$718
2030	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.294	$677
2031	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.278	$640
2032	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.262	$603
2033	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.247	$569
2034	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.233	$536
2035	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.220	$506
2036	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.207	$476
2037	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.196	$451
2038	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.185	$426
2039	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.174	$400
2040	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.164	$377
2041	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.155	$357
2042	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.146	$336
2043	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.138	$318
2044	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.130	$299
2045	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.123	$283
2046	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.116	$267
2047	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.109	$251
2048	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.103	$237
2049	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.097	$223
2050	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.092	$212
2051	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.087	$200
2052	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.082	$189
2053	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.077	$177
2054	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.073	$168
2055	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.069	$159
2056	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.065	$150
2057	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.061	$140
2058	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.058	$133
2059	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.054	$124
2060	Avoided imported water use	AF	0	1.53	1.53	$1,500	$2,302	0.051	$117
Project life	Avoided imported water use	AF		74		$ 75,000.00			
					Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)				$30,359

Comments: Avoided imported water use only applies to Napa Valley Rainwater Harvesting Project.

Improved Water Supply Reliability

The reliability of a water supply refers to the ability to meet water demands on a consistent basis, even in times of drought or other constraints on source water availability. Water supply reliability is of concern in the Bay Area region because about 70% of the water supply in the area is imported from the San Francisco Bay or the Sacramento-San Joaquin Delta, via the State Water Project (SWP) or the Central Valley Project (CVP).

The availability of water imported from the Delta is subject to a number of natural and human forces, ranging from increased population growth (and accompanying increased demands), to drought and earthquakes, to environmental regulations and water rights determinations. The availability of drinking water from the Delta is further threatened by the potential for levee failure that could lead to flooding and seawater intrusion, which would result in non-drinkable water. Global climate change and rising sea levels may also create greater stress on the levee system.

In addition, many of the aquifers in the San Francisco Bay region are currently being pumped at or near practical sustainable yield. Local surface water supplies are also limited due to existing water rights and diversions by multiple users, low flows during summer (which coincides with the irrigation season) and dry years, and in-stream flow requirements for riparian habitat and aquatic species.

Although interest in water supply reliability is increasing (e.g., due to increasing water demands and concerns over climate-related events), only a few studies have directly attempted to quantify its value (i.e., through non-market valuation studies). The results from these studies indicate that residential and industrial (i.e., urban) customers seem to value supply reliability quite highly. Stated preference studies find that water customers are willing to pay $95 to $500 per household per year for total reliability (i.e., a 0% probability of their water supply being interrupted in times of drought). In most cases, this is the amount customers would be willing to pay in addition to their current water bill.

By increasing water conservation, GI projects can increase water supply reliability. The challenge for use of these values to determine a value of increased reliability as a result of the project is recognizing how to reasonably interpret these survey-based household monetary values. The values noted above reflect a willingness to pay per household to ensure complete reliability (zero drought-related use restrictions in the future), whereas the GI projects only enhances overall reliability, but does not guarantee 100% reliability. Thus, if applied directly to the number of households within region, the dollar values from the studies would overstate the reliability value provided by the proposed project. Due to the uncertainty involved in applying these numbers to this situation, this benefit estimate is not included in the tables.

Additional Future Water Supply Benefits

The primary objective of the Regional Green Infrastructure Capacity Building Program is to develop and improve techniques for better stormwater management in the Bay Area by: 1) analyzing each project to determine water conservation and/or stormwater quality benefits, and 2) disseminating information on lessons learned from the projects to other cities, counties and water management entities in the region. The pilot projects will be used as tool to enable the use of GI and LID at the regional level. This will result in future water conservation and groundwater recharge benefits throughout the Bay Area at a much larger scale.

The value of the knowledge gained from these pilot efforts is expected to be considerable, such as leading to enhanced and wider-scale implementation of those GI and LID approaches that are found to be most effective (and avoiding investments in projects or approaches that may be shown to be less effective). No monetary value is assigned to this benefit, but the knowledge and confidence gained from these projects are likely to provide significant value in the future to utility practitioners/planners, and the communities they serve.

Improved Water Supply Reliability

The reliability of a water supply refers to the ability to meet water demands on a consistent basis, even in times of drought or other constraints on source water availability. By reducing potable water demand through water use efficiency, the Regional Water Conservation Program will improve water supply reliability within the service areas of the various agencies and also increase the Bay Area region's capacity to manage long-term drought scenarios and other strains on the Bay Area water supplies and the Delta.

Although interest in water supply reliability is increasing (e.g. due to increasing water demands and concerns over climate-related events), only a few studies have directly attempted to quantify its value (i.e., through non-market valuation studies). The results from these studies indicate that residential and industrial (i.e., urban) customers seem to value supply reliability quite highly. Stated preference studies (e.g. Raucher et al., 2006) find that water customers are willing to pay $95 to $500 per household per year (in 2009 USD) for total reliability (i.e., a 0% probability of their water supply being interrupted in times of drought).

Due to the uncertainty involved in applying these numbers to this situation, this benefit estimate is not included in the tables. However, it is provided here to give an idea of the potential magnitude of this benefit.

Additional Future Water Supply Benefits

The primary objective of the Regional Green Infrastructure Capacity Building Program is to develop and improve techniques for better stormwater management in the Bay Area by: 1) analyzing each project to determine water conservation and/or stormwater quality benefits, and 2) disseminating information on lessons learned from the projects to other cities, counties and water management entities in the region. The pilot projects will be used as tool to enable the use of GI and LID at the regional level. This will result in future water conservation and groundwater recharge benefits throughout the Bay Area at a much larger scale.

The value of the knowledge gained from these pilot efforts is expected to be considerable, such as leading to enhanced and wider-scale implementation of those GI and LID approaches that are found to be most effective (and avoiding investments in projects or approaches that may be shown to be less effective). No monetary value is assigned to this benefit, but the knowledge and confidence gained from these projects are likely to provide significant value in the future to utility practitioners/planners, and the communities they serve.

5 Distribution of Project Benefits, and Identification of Beneficiaries

In terms of water supply, the GI Capacity Building Program will benefit stakeholders at the local, regional, and state level. Locally, Napa County will benefit from cost savings associated with reduced reliance on imported water. Regional and statewide benefits include increased groundwater recharge and reduced reliance on Delta water.

6 Project Benefits Timeline

The San Pablo Stormwater Spine Project is scheduled for completion in 2013. For this analysis, it is assumed that the project will come online in 2014 and will have a 20-year useful life. The Hacienda Green Street Improvement Project will be completed in 2012 and will have a 25-year useful life. Implementation of Napa Valley Rainwater Harvesting Project will begin in 2011 and will continue through 2015. Benefits for this project are calculated through 2060, 50 years after the project begins to come online in 2011. The timing of future GI projects that will build upon the proposed pilot projects has not yet been established.

7 Potential Adverse Effects from the Project

There are no adverse effects anticipated from the implementation of this program. Temporary traffic disruptions may occur during project construction of the green street projects, but will be mitigated to a less-than-significant level.

8 Summary of Findings

The monetized water supply benefits from the proposed project include the value of avoided imported water supply costs due to increased water conservation associated with rainbarrels. The value of these savings is $1,500 per AF of avoided imported water. Assuming the rainbarrels will each conserve 667 AFY of stormwater, the total present value of this benefit amounts to $30,359 over the 50-year life of the Napa Valley Rainwater Harvesting project.

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In most cases, omissions lead to a downward bias in benefits: the project is expected to be much more beneficial than the subset of benefits that can be monetized would indicate. These issues are listed in Table 4 on the following page.

Table 4. Omissions, Biases, and Uncertainties, and Their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Additional future water supply benefits	++	The primary objective of the pilot projects is to increase GI implementation in future years. This will result in significant water supply benefits for the Bay Area region. These benefits are not included in the economic analysis because they are dependent to some extent on the findings from the pilot projects.
Increased water supply reliability	+	The potential benefit of increased water supply reliability as a result of the project has not been included due to uncertainties to applying values from the literature to a partial improvement in water supply reliability in this specific setting and circumstance.
Water conservation and groundwater recharge	U	It is uncertain how much water will be stored in rainbarrels or infiltrated into the groundwater aquifer each year as a result of the project. For example, in some years, more than 39 AF of stormwater will be available for recharge, in some years it may be less. Benefits will vary accordingly.
Project costs	U	The calculation of the present value of costs is a function of the timing of capital outlays and a number of other factors and conditions. Changes in these variables will change the estimate of costs.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

References

(BAWSCA) Bay Area Water Supply and Conservation Agency. 2010. Long-term Reliable Water Supply Strategy, Phase 1 Scoping Report.

Available: http://bawsca.org/docs/BAWSCA_Strategy_Final_Report_2010_05_27.pdf. Accessed December 22, 2010.